Esophageal Function: An Under Evaluated Component of Bariatric Surgery

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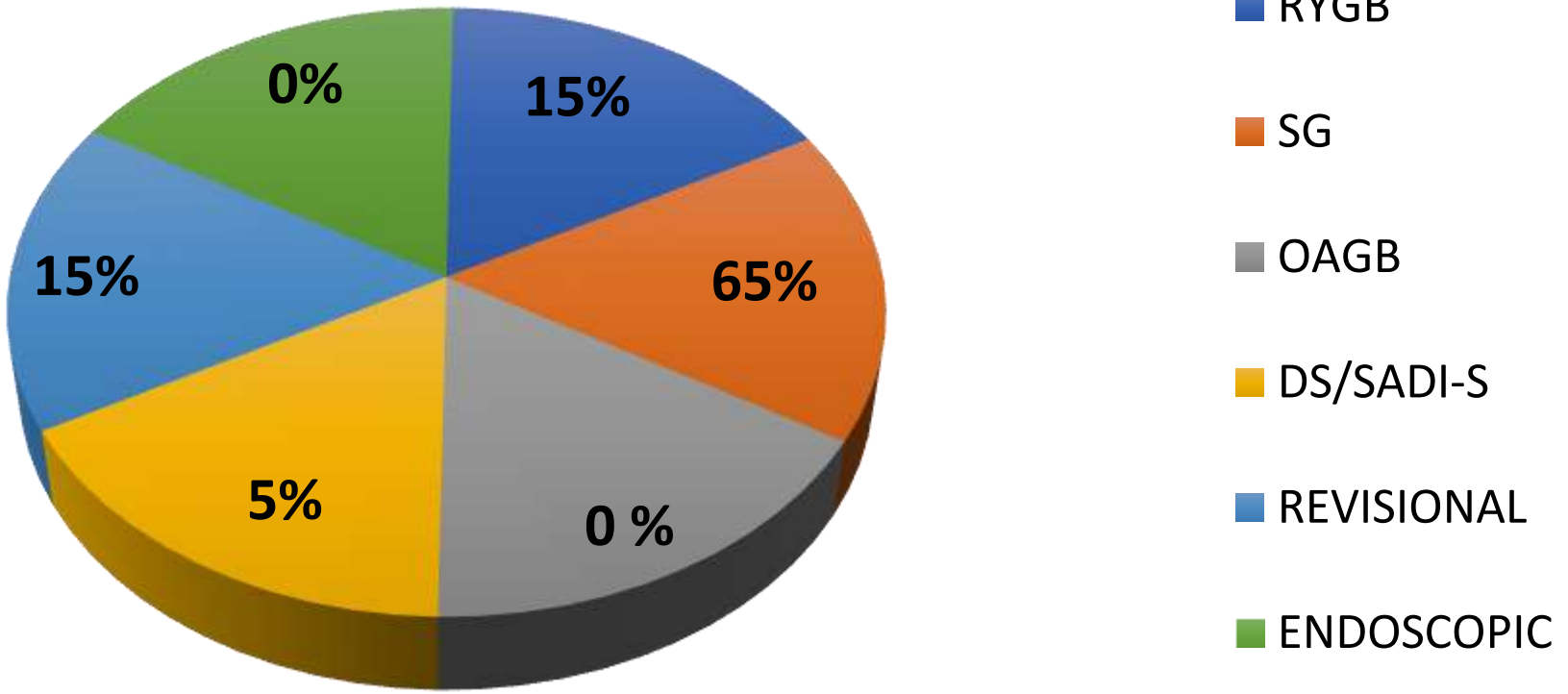
CONFLICT OF INTEREST DISCLOSURE

Honoraria for teaching:
WL Gore, Medtronic, Ethicon, Ezisurge, Stryker, Vivus

CASE MIX DISCLOSURE



CASE MIX DISCLOSURE

Total CASE Volume:

- RGB: 1800
- Sleeve: 1900
- Lap Band 2000
- Revisions: 1200

Normal Esophageal Function

- High Resolution Manometry (HRM)
- High Resolution Impedance Manometry (HRIM)
- Transnasal catheter with 36 pressure sensors, tip positioned across diaphragm 2-3 cm
- 7-10 swallows of 5 ml
- Integrated Relaxation Pressure (IRP): If abnormal, indicates abnormal transit across EGJ
- Check position of patient
  - Lower pressures when seated

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Issue: *The Esophagiome*

Novel insights into esophageal diagnostic procedures

Edoardo Savarino,[1] Andrea Ottonello,[2] Salvatore Tolone,[3] Ottavia Bartolo,[1] Myong Ki Baeg,[4] Farhood Farjah,[5] Shiko Kuribayashi,[6] Katerina P. Shetler,[7] Christian Lottrup,[8,9] and Ellen Stein[10]

- Esophageal motility
  - Integrated relaxation pressure (IRP)
  - Distal contractile integral (DCI)
  - Intrabolus pressure (IBP)
  - Contractile front velocity (CFV)
  - Distal latency (DL)

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- The IRP represents swallow-related esophagogastric junction (EGJ) relaxation pressure- impaired EGJ relaxation
- DCI measures magnitude of contractile vigor - hypercontractility and hypocontractility
- CFV assesses peristaltic velocity
- DL is the time from the onset of swallow-related upper esophageal sphincter relaxation and the time at which esophageal contraction reaches the distal esophagus
  - Used to evaluate the presence of spastic esophageal contraction instead of CFV

Normal Esophageal Function

- Distal Contractile Integral (DCI): Vigor of Peristalsis, 450-8000mmHg
- Distal Latency (DL): Start of swallow to inflection wavefront before EGJ
- Peristaltic Integrity: Gaps in the contraction= fragmented swallow

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Esophageal Dysmotility

- DCI<450
- Failed or Ineffective Swallows
- LES pressure
- EGJ outlet obstruction

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- IEM has been found to be a common motility disorder in patients with GERD with or without BE, with a prevalence of up to 49.4%
- Most likely cause of the dysphagia in this group of patients
- Bolus retention results from weakened peristaltic contractile waves in patients with peptic esophagitis.
- Patients with normal esophageal pH have more significant abnormalities in esophageal peristalsis, with higher prevalence of failed esophageal peristalsis.
- Heartburn, regurgitation, and belching are more prevalent in patients with IEM and underlying acid reflux
- HRIM can also distinguish between regurgitation and rumination

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- Three morphological types of EGJ based on the presence of axial cranial separation between the LES and the CD
  - type I, no separation between the LES and the CD
  - type II, minimal separation (>1 and <2 cm)
  - type III, >2 cm of separation

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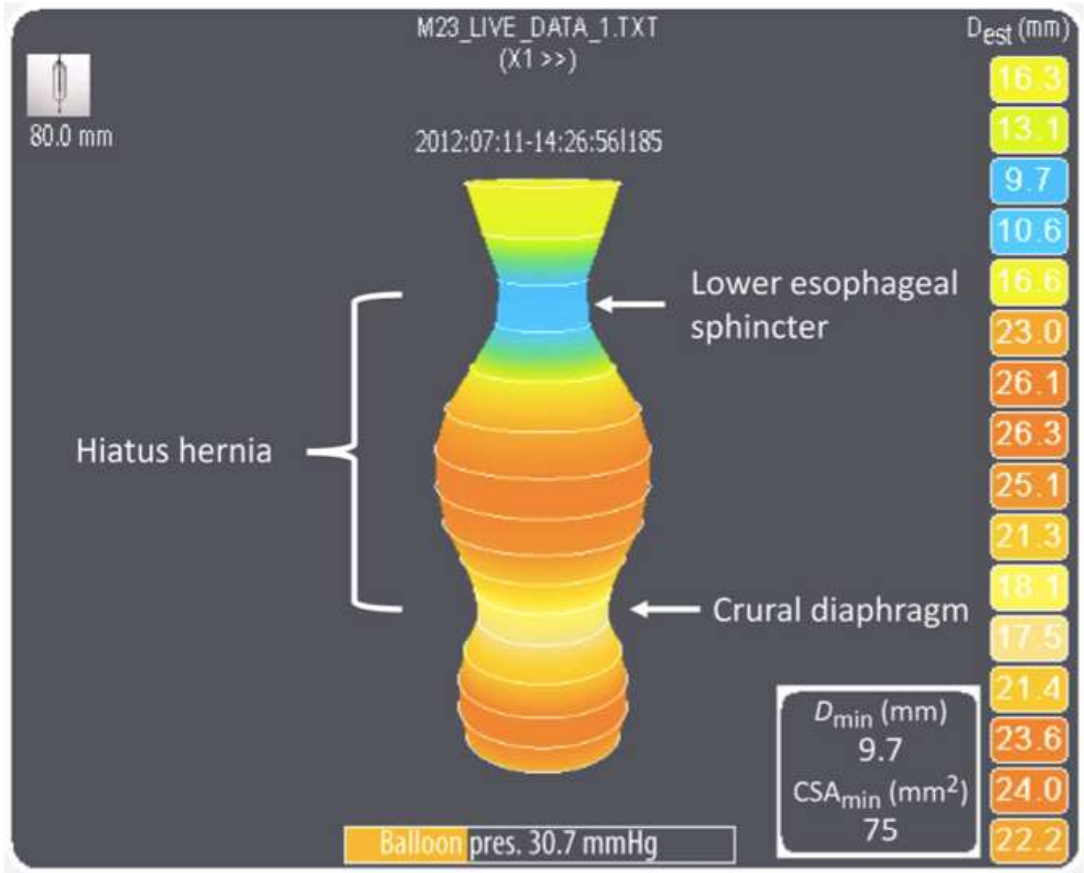

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Although some studies have indicated that distensibility testing has a potential for predicting, for example, the outcome of surgery, this application needs to be confirmed in future studies before definite conclusions can be made

Preop Manometry

- 116 obese patients (81 women and 35 men) selected for laparoscopic gastric banding underwent manometric evaluation
- In 41% of the patients: nonspecific esophageal motility disorders (23%), nutcracker esophagus (peristaltic amplitude >180 mmHg) (11%), isolated hypertensive LES pressure (>35 mmHg) (3%), isolated hypotensive LES pressure (<12 mmHg) (3%), diffuse esophageal spasm (1%), and achalasia (1%). One patient with abnormal esophageal motility reported noncardiac chest pain.
  - J S Koppman, Surg Endosc 2007

Asymptomatic patients

- 53 obese patients
- Esophageal manometry revealed dysmotility in 51% (n=27)
- Esophageal body in 74% (n=20) of the patients and the inferior sphincter in 11% (n=3)
- Mixed dysmotility (body and inferior sphincter) was found in 15% (n=4) of cases
- The esophageal body dysmotilities were **hypomotility in 85%** (n=23) : from insignificant waves (74% [n=20]), nonpropagated waves (11% [n=3]) or low-amplitude waves (33% [n=9]).
    - Justin Côté-Daigneault, am J Gastroenterol Hepatol 2014

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Preop Esophageal Function

- 114 patients
- Average BMI of 45.3
- Typical GERD symptoms in 43 (38%) patients;71 (62%) were asymptomatic
- Eighty two patients (72% of total) underwent EGD and 36 (42%) had abnormalities
  - hiatal hernia in 36%, erosive esophagitis (EE) in 36%, and HH+EE in 28%.
    - Eponina Maria de Oliveira Lemme, Arq Gastroenterol, 2021

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Preop Esophageal Function

- Abnormal Manometry in 51/114 patients (45%)
  - hypotensive lower esophageal sphincter (LES) in 32%, ineffective esophageal motility in 25%, nutcracker esophagus in 19%, IEM + hypotensive LES in 10%, intra-thoracic LES (6%), hypertensive LES (4%), aperistalsis (2%) and achalasia (2%).
  - **Among the 43 symptomatic patients, 23 (53%) had abnormal manometry and 31/71 asymptomatic cases (44%) also presented**
    - Eponina Maria de Oliveira Lemme, Arq Gastroenterol, 2021

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Preop Esophageal Function

- PHM showed abnormal reflux in 60/114 patients (53%), with a predominance of bi-positional reflux (42%), followed by supine reflux (33%) and upright reflux (25%)
- **Abnormal PHM was found in 26/43 symptomatic cases (60%) and also among 34/71 asymptomatic cases (48%)** (P=0.19).
- **Conclusion:** There was no correlation between the finding of motor abnormalities and the presence of symptoms. Also no significant correlation between abnormal reflux and the presence of symptoms.
    - Eponina Maria de Oliveira Lemme, Arq Gastroenterol, 2021

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Preop Testing

- 88 patients awaiting bariatric surgery
- Esophageal pH monitoring tests were positive in 65% of the patients
- Manometries showed lower esophageal sphincter hypotonia in 46/88 pts
- 20% had abnormal upper endoscopy results
- Out of the 45% of patients who were asymptomatic or HAD normal endoscopies, half HAD positive esophageal pH tests.
- Among the 55% of patients who had symptoms or an abnormal upper endoscopy, three quarters had pH tests that diagnosed reflux.
- No statistically significant relationship was found between body mass index, sex, age, manometry, or hiatus hernia and the positive pH monitoring.
    - Jesica Martín-Pérez, Surg Obes Relat Dis 2014

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Preop testing

- Investigate prevalence and phenotype of (borderline) GERD and esophageal motility disorders morbidly obese patients.
- HRM, ambulatory 24-h pH impedance monitoring, endoscopy
- 147 patients, median BMI of 44 (40.9; 49.4) kg/m^2
- The Chicago Classification revealed motility disorders in 50 (34%) patients, dominated by outflow obstruction (18.4%, n = 27) and a novel disorder (7.5%, n = 11), nicknamed jackhammer esophagus (JE)
- 52 (35.4%) patients had evidence of true GERD, whereas borderline GERD was noted in another 60 (40.8%)
    - Ivan Kristo, Obes Surg 2019

> Can J Gastroenterol Hepatol. 2015 Jan-Feb;29(1):49-51. doi: 10.1155/2015/490818.

Plasma leptin concentrations and esophageal hypomotility in obese patients

Justin Côté-Daigneault, Pierre Poitras, Remi Rabasa-Lhoret, Mickael Bouin

Nine patients without dysmotility and eight with dysmotility were included

When compared with normal predicted values, the corrected leptin scores were 30% higher in patients with dysmotility than in the control group with normal motility

> Rom J Intern Med. 2021 Aug 26;59(3):296-302. doi: 10.2478/rjim-2021-0008. Print 2021 Sep 1.

Impact of laparoscopic sleeve gastrectomy on esophageal physiology

Andrada-Loredana Popescu [1 2], Florentina Ioniţa-Radu [1], Mariana Jinga [1 2], Vasile-Daniel Balaban [1 2], Raluca-Simona Costache [1 2], Florin Săvulescu [1], Carmen Fierbinţeanu-Braticevici [2 3]

Median interval of 7.9 months.
GERD prevalence increased from 17.8% to 31.1% postoperatively
New GERD onset in 22.2%

Postoperative reflux was associated with lower esophageal sphincter (LES) hypotonia, shortening of LES length and IIGP (increased intragastric pressure)

3 patients were diagnosed with de novo esophagitis

The prevalence of manometric dysmotility after LSG was 28.9%, lower than before surgery (44.4%).

> Obes Surg. 2021 Feb;31(2):725-737. doi: 10.1007/s11695-020-04988-1. Epub 2020 Sep 22.

Mechanisms of Esophageal and Gastric Transit Following Sleeve Gastrectomy

Yazmin Johari [1 2], Anagi Wickremasinghe [3], Pradipta Kiswandono [3], Helen Yue [4], Geraldine Ooi [3 5], Cheryl Laurie [3], Geoffrey Hebbard [6], Paul Beech [4], Kenneth Yap [4], Wendy Brown [3 5], Paul Burton [3 5]

- Repeated esophageal peristaltic contractions induced isobaric pressurization of proximal stomach providing the drive to pressurize and empty the vertical compartment of the gastric sleeve
- Transit following SG appeared to be esophageal-mediated and followed a distinct cycle with strong associations with reflux.

- Gerd at 3 months or 2 years
  - Himpens

> Am J Gastroenterol. 2020 Oct;115(10):1669-1680. doi: 10.14309/ajg.0000000000000733.

Postobesity Surgery Esophageal Dysfunction: A Combined Cross-Sectional Prevalence Study and Retrospective Analysis

Alexander T Miller [1], Reem Matar [1], Barham K Abu Dayyeh [1], Azizullah Beran [1], Marcelo F Vela [2], Brian E Lacy [3], Michael D Crowell [2], Debra M Geno [1], Crystal J Lavey [1], David A Katzka [1], Karthik Ravi [1]

97/137 patients had HRIM after laparoscopic sleeve gastrectomy [n = 39, 40.1%]; Roux-en-Y gastric bypass [n = 58, 59.8%] at a median of 5.84 years postoperatively

40 preoperative bariatric surgery candidates with medically complicated obesity also had HRIM

Achalasia was identified in 7 (7.2%) postsurgical patients only

An achalasia-like pattern defined by aperistalsis and increased intragastric pressure (postobesity surgery esophageal dysfunction [POSED]) in 5 (5.2%) postsurgical patients

> Am J Gastroenterol. 2020 Oct;115(10):1669-1680. doi: 10.14309/ajg.0000000000000733.

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- Increasing time since surgery was independently associated with the development of
  - achalasia (median 12.5 vs 5.8 years, P = 0.02)
  - POSED (median 15.0 vs 5.8 years, P = 0.02)
  - major motility disorders (6.6 vs 4.9 years, P = 0.01)
- Prevalence of dysphagia was 13.7% at a mean 3.9 years after surgery

› Surg Endosc. 2023 May;37(5):3832-3841. doi: 10.1007/s00464-022-09857-9.
Epub 2023 Jan 24.

Esophageal function and non-acid reflux evaluated by impedance-24 h-pH-metry, high-resolution manometry, and gastroscopy after one-anastomosis gastric bypass-outcomes of a prospective mid-term study

D M Felsenreich [1], M L Zach [1], N Vock [1], J Jedamzik [1], J Eichelter [1], M Mairinger [1], L Gensthaler [1], L Nixdorf [1], P Richwien [1], C Bichler [1], I Kristo [1], F B Langer [1], G Prager [2]

21 patients
Anastomositis, esophagitis, Barrett´s esophagus, and **bile in the pouch** were found in: 38.1%, 28.3%, 9.5%, and **42.9%**
Results of HRM of the lower esophageal sphincter pressure were 28.0 ± 15.6 mmHg, which are unchanged compared to preoperative values
impedance-24 h-pH-metry, acid exposure time and DeMeester score decreased significantly
The total number of refluxes were equal to preoperative BUT **the decreased acid refluxes were replaced by non-acid refluxes**

> J Laparoendosc Adv Surg Tech A. 2022 Feb;32(2):103-110. doi: 10.1089/lap.2020.0999. Epub 2021 Apr 12.

Does Roux-en-Y Gastric Bypass Really Cure Gastroesophageal Reflux Disease? Analysis of Objective Data

Verónica Gorodner [1], Agustín Matucci [1], Laura Solé [2], Ricardo Figueredo [2], Christian Sánchez [2], Luis Caro [2], Alejandro Grigaites [1]

250 LSG candidates underwent preoperative EFTs

38% were redirected to LRYGB due to abnormal pH

Lower esophageal sphincter (LES) length increased from 2.6 to 2.9 cm

LES pressure decreased from 15 to 14.2 mmHg

DeMeester score decreased from 35.7 to 11

Postoperatively, 69% patients resolved their GERD, 23% improved, and 8% remained the same

Need for Acid Suppressive Therapy post Fundoplication

- 339 patients, retrospective review
- 39.5% went on AST following fundoplication with a median time to AST use of 15 months
- The most common reason for AST use was heartburn but only 29% of patients had objective evidence of acid reflux
    - Carol Rouphael, Scand J Gastroenterol 2020

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Esophageal Pathophysiologic Changes and Adenocarcinoma After Bariatric Surgery

- 27 nonrandomized studies (SG: 612 patients; RYGB: 470 patients) were included.
- After SG, lower esophageal sphincter pressure and esophageal body amplitude were decreased and the risk of ineffective esophageal motility was increased.
  - Total and recumbent acid exposure times were increased.
- After RYGB, an increased risk of ineffective esophageal motility was observed.
  - Total, upright, and recumbent acid exposure times were decreased.
  - The total reflux episodes remained unchanged but with increased nonacid reflux and decreased acid reflux events.
    - Veeravich Jaruvongvanich, Clin Transl Gastroenterol 2020

Esophageal Pathophysiologic Changes and Adenocarcinoma After Bariatric Surgery

- 31 EAC cases have been reported to date after SG and RYGB.
- This systematic review demonstrates increased acid reflux after SG and decreased acid reflux after RYGB.
- An observed **increased nonacid reflux after RYGB might contribute to failure of gastroesophageal reflux disease improvement**
- This refluxate might be noxious to the esophagus, warranting further studies.
- RYGB might not entirely preserve esophageal function as previously believed.
    - Veeravich Jaruvongvanich, Clin Transl Gastroenterol 2020

Belching and effects p rgb

- 12 healthy volunteers and 17 patients p RGB and OAGB
- the pathologic acid reflux (DeMeester score > 14) rate was similar in both groups (11.8% vs. 8.3%)
- Regarding the impedance, symptom-association probability was positive in 11.8% of bariatric patients and higher alkaline reflux rates (6% vs. 0%)
- 50% of them experienced belching based on the questionnaire
- **Bariatric patients had a significantly higher number of gas reflux (123.24 ± 80 vs. 37.2 ± 21.5, P = 0.001) and supragastric/ gastric belches** (182 ± 64/228 ± 66.69 vs. 25.08 ± 15.20/12.17 ± 17.65, P = 0.001)
- Supragastric belching was more frequent than gastric belching in the controls, whereas **gastric belching was more frequent in the patients.**
    - F Akyüz, ta Gastroenterol Belg 2021

Warning Signs

- “I can’t tolerate liquids”
- “I could never get my band adjusted because I threw up immediately”
- Weird food Intolerances

Knowledge is power

- Ask questions re symptoms
- Ask questions re diet
  - Maybe can’t tolerate dense foods
  - Maybe large bolus eaters
- Testing testing testing
- Manometry can help!
  - 38 year old female, 10 yrs p rgb w weight recurrence and HHR
  - Candidate for HHR, distalization
  - 100% ineffective swallows
  - I did the distalization and didn’t do the HHR

Conclusions

- Asymptomatic patients can have significant acid reflux and dysmotility
- Symptomatic patients will have a higher likelihood of significant esophageal pathology
- EGD and GERDQL should be done in all patients
- Manometry is necessary in certain patients primarily
- Manometry is necessary in many more revisions especially post band and sleeve

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